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THE ROLE OF THE BACTERIOLOGIST IN WAR AND DEFENSE

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Public Health Service
Cincinnati, Ohio

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THE ROLE OF THE BACTERIOLOGIST IN WAR AND DEFENSE.*

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The strength of the nation lies in the health of its people. Health is the first line of defense. Instruments of destruction, which constitute the secondary line, whether for offense or defense, cannot function efficiently unless they are manned by healthy, strong bodies and alert minds.

Moreover, the success of a combat unit is dependent entirely on the effective operation of a number of other units behind the scene of action. It has been aptly said that an army travels on its belly, signifying the importance of food. Not only food but also munitions, machines, guns, airplanes, tanks, clothing and supplies of all kinds, for additional needs and for the replacement of expended items must be continuously produced, efficiently produced, and quickly transported to the point of use. A shell that fails to explode or a machine that fails or hesitates in its operation is worse than no provision at all, for valuable time has been lost at a critical moment. The maintenance of a high standard of health and the prevention of disease in all walks of life - from the farmer who tills the soil producing the raw food materials - to the skilled

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(*) Delivered before the Ohio Branch of the Society of American Bacteriologists, November 9, 1940, at Columbus, Ohio.

worker in the instrument factory producing a bomb sight delicate enough for an aviation gunner to hit a small target from a 4 mile elevation - to the combatants themselves, is a primary essential for a prosperous nation or for a successful campaign.

The State and Territorial health officers met with the United States Public Health Service on May 9, 1940, in annual conference. Since that time the current program for national defense has so emphasized many problems dealing with public health and physical fitness that a special conference of this group was recently called. This special conference was attended not only by the State and Territorial health officers and members of the United States Public Health Service, but also by the National Advisory Health Council, officials of the Army, the Navy, and representatives of other branches of the Federal Government, voluntary health agencies and professional organizations. The following agenda was presented to this special conference for their present and future consideration:

1. Administration of the Selective Training and Service Act of 1940.
2. Health services for National Youth Administration enrollees. (These men, 18 to 20 years inclusive, are eligible now for civilian employment and will soon be for military service).

3. Physical rehabilitation of registrants disqualified for military service.

4. Serologic tests of registrants for military service. (Senior Surgeon O. C. Wenger, U. S. Public Health Service, estimates there will be about 300,000 cases of syphilis alone among the registrants. The application of this single test will require about 160,000 man-hours in the laboratory. Yet each untreated case will serve as a focus for new infections and this disease ranks third in the causes for loss of time in the Army).

5. Pertinent needs in industrial hygiene.

6. Health aspects of Civil defense.

7. Control of selected communicable diseases.

8. Health administration problems arising out of mobilization.

9. Census of public health personnel and facilities. (As there is a definite indication that there will be a shortage of competent laboratory workers your obligation in carrying on such studies and in training such individuals is definitely marked).

Even if time permitted it is not necessary to tell you, as Bacteriologists, in detail of the part that the bacteriologist plays in a program for the maintenance of health and the prevention of disease. A cursory examination of such treatises as Rosenau's "Preventive Medicine and Hygiene", Park's "Public

Health and Hygiene", or Fauntleroy's "Report of the Medico-Military Aspects of the European War", yields a thorough concept of the magnitude of the problem and the Bacteriologists' part in its solution. It is sufficient to outline briefly the major factors and then to consider in detail, as illustrations, a few of the hazards which are peculiar to war and to national defense or which are made more of a potential danger under such conditions.

Aside from the control of industrial hazards intensified by accelerated production employing new and perhaps toxic materials, and the factors to be considered in connection with wounds, which will be taken up later, the major health hazards involved here, which are subject to bacteriological control measures, may be divided into two general groups: (1) those contracted largely through food and drink, such as typhoid fever, the para's, dysentery, cholerae, etc., and (2) those spread chiefly by close contact, such as influenza, pneumonia, meningitis, scarlet fever, diphtheria, etc.

For the first group of these diseases adequate bacteriological control of the water supply and of the disposal of sewage certainly constitutes the major line of prevention. At a permanent location, such as a city, an industrial plant, or a training camp, a water supply drawn from a suitable source, filtered and chlorinated, should be available. This supply should be examined daily by competent bacteriologists

to determine its continuous quality. Samples for such examination should include not only those collected from the purification plant, but also from well-dispersed points on the distribution system. From a bacteriological viewpoint, the water should be required, as a minimum, to meet the requirements of the Treasury Department Standard. Consideration must be taken of the possibility that the existing water supply facilities may be overtaxed by the increased demand. Under such conditions, it is difficult to continuously produce a safe effluent.

For temporary field locations, where circumstances may not permit the selection of a suitable source, or time may not be available for bacteriological examinations, recourse must be made to boiling, chlorinating, or filtering. Suitable equipment is now obtainable for carrying out either process under such field conditions. In this, while bacteriological examinations are not involved, the bacteriologist should still do the work or, at least, intimately supervise it, for critical temperatures must be maintained, filtration must be adequate and the amount of residual chlorine must be checked accurately. It is not reasonable to presume that such processes would be effectively carried out by someone unfamiliar with the principles concerned and with the nature of the impending dangers.

In the permanent location, provision for adequate and safe disposal of sewage should be available. Here, safe dis-

posal should include a consideration of the safety of other communities, both civil and military, as well as of the contributing population. In the other extremity where neither time nor opportunity permit the use of modern or semi-modern methods resort must be made to the biblical injunction for primitive peoples to bury their fecal discharges in sandy soil. Here again, throughout the regime of possible processes, from one extreme to the other, the need is imperative for intimate supervision by one schooled in the principles and in the dangers involved. The further the process is forced toward the primitive the more drastic the need for control. While it is admittedly a far cry from the habitat of the research worker in the modern laboratory to the duties implied here, the facts are sound and the need appears to justify the end. Most bacteriologists we think have uncommon, common sense.

In the field of personal immunization against this group of diseases established success has been attained only with typhoid fever and the paras. Undoubtedly, in the armed forces, for this group of infections, the recruit will be given essentially the same inoculations as were administered during the World War along with vaccination against smallpox. It is to be hoped that these preventive treatments may be invoked by the civil population as well.

For the second disease group, those spread by contact, means for prevention by immunization are not available, although new vaccines for protection against pneumonia, influenza, and

typhus fever are being given field trials. Special effort is being made, which it is hoped will be successful, to forestall the outbreak of such epidemics of influenza and epidemic meningitis as became such a serious problem in the winters of 1917 to 1919. In one extra-cantonment zone at that time all of my time (constituting on the average about 14 hours a day) and the time of four other bacteriologists was occupied in searching for meningococci from possible carriers and from the spinal fluids of acute cases. The same condition prevailed in the camp laboratory and in similar set-ups in other localities. The results obtained would suggest that the search for carriers certainly of those not in immediate contact with acute cases, might well be omitted from the schedule occupying the bacteriologist's time. The isolation and identification of organisms from the spinal fluid of victims (particularly first fluids) might well be continued for three reasons: (1) For value to be derived in the treatment of the particular case; (2) To locate possible new strains which might not be available antigenically for the preparation of therapeutic antisera; and (3) To provide material for the study of the effect of certain new drugs on such strains.

With this group of diseases a definite program of work is indicated for the bacteriologist; not only in the practical routine work outlined here but also in a research study of the efficiency of drugs of the sulfanilamide family in the treatment of infections of this type. Indeed, in this respect

an entirely new line of research is called for to find some drug, or drugs, that will be effective in the treatment of insect-borne diseases. Such insect-borne infections, of which malaria is the type, are almost sure to be of major concern in camps and extra-camp zones located in southern sections of the country. For one of these infections, yellow fever, a vaccine for active immunization has been developed. If troops are located in zones where yellow fever is endemic this vaccine will undoubtedly be given a trial on a major scale.

Passing now to a consideration of bacteriological interest in wounds, aside from the deforming nature of the wound itself, the two factors of major importance are (1) shock, and (2) the dangers of infection with toxin-producing anaerobes.

1. The consensus appears to be that the only definite relief for shock is the immediate replacement of body fluids. With the older method of direct transfusion employed for this purpose there is no need for the services of a bacteriologist. With the more recent procedure using blood banks careful preparation of the bank and the maintenance of its sterility are essential. The newest method, employing dehydrated plasma, while not yet adopted as a standard procedure, appears to be producing as favorable results as either blood banks or direct transfusions. For this transfusing medium plasma is used instead of whole blood, the plasma is dehydrated, stored in dehydrated powdered form and is put in solution again just before use. While typing problems do not arise with this medium

along with other apparent advantages, its use calls for adequate bacteriological supervision in the collection, dehydration, storage and resolution of the plasma with sterility tests made at each step of the process.

2. For the control of toxin-producing anaerobic infections, both active and passive immunization are now available. Active immunization, a new development under consideration but not made official, is carried out by the injection of appropriate amounts of detoxified toxin at about weekly intervals for three weeks, with an additional injection of one dose at yearly intervals, or at the time of an injury. The preparation, standardization and preservation of this toxoid as well as of the antitoxin used for passive immunization are all of major importance and consequently are marked for intensive bacteriological work. During the World War very serious difficulties developed in the use of such antitoxins because of wide variations in the potency of different batches. Variation in the units adopted for standardization and in the technique employed to determine potency were to a great extent responsible for these difficulties. The antitoxins produced and standardized by a few American firms were the only ones which could be definitely relied upon. Since that time considerable progress has been made in the preparation of antitoxins, in the technique of standardization and in the adoption of uniform units of potency. Careful attention to these details in the bacteriological laboratory should avoid the recurrence

of these difficulties in the future.

In the treatment of wounds the desire of the surgeon is to remove insofar as possible any infectious organisms introduced at the time the wound was inflicted. He most certainly does not want to introduce any infection through his own procedures. To a great extent the materials and the instruments the surgeon uses are under his control and he can assure himself of their sterility and be certain of his technique. However, one item in particular, the surgical suture for internal use, is not under his control. Let us consider this item. The surgical suture has four primary requisites: (1) it must have sufficient tensile strength and flexibility to hold the concerned tissues firmly together, (2) it must be of such material and of such a nature that it will not lose its strength until its mission is fulfilled, (3) it must be subject to ready dissolution and adsorption soon after its job is completed, that is, the surgeon must know its relative survival time, and (4) it must be sterile.

From a manufacturing standpoint these requirements are not easy to attain. The essential steps required to make the product meet one specification may so alter the suture that it will not meet another; for example, the treatment required to make the suture hold fast for 20 days may render it resistant to final adsorption, or the methods employed to effect sterility, thermal or chemical, may markedly alter the tensile

strength. The processing must be adjusted very carefully and the range for the factor of safety is limited. Moreover, the raw material used for the preparation of such sutures, the musculature of the intestine of the sheep, normally harbors millions of tetanus organisms within its walls. For all these reasons, it is expedient that a careful bacteriological control of this product be established and maintained. The best way to carry out the field part of such a control procedure is to hold each batch of processed sutures intact until the examination of a representative portion selected at random has been completed in the laboratory. The entire batch, depending on the results of the examination, can then be released, rejected for destruction, or returned for additional processing. The examination should include tests for: tensile strength, solubility, and sterility. Our fellow member, Mr. Ey, Director of the laboratory of the Ohio State Board, who was associated with me in this work during the World War, I am sure will agree with me in this matter.

The majority of the public health problems involving the need of a bacteriologist are common to any community. Particular items for special consideration will vary to some extent with the location of the community, depending on the climate and the environmental conditions. However, when groups of individuals are removed from their natural habitat, which may be quite varied, and are re-established in a new community, in a new location, such as a training camp, experience has

shown that, for some reason or reasons, the hazards to health are greatly increased and the vigilance of those responsible for the maintenance of health must be increased correspondingly. Naturally, the public health matters of such a camp are regulated by the sanitary or medical unit of the corps establishing the camp. However, in our governmental system, particularly in peace times, the authority of this corps does not extend beyond the borders of the camp zone.

Moreover, it invariably happens that the population of the zone surrounding the camp increases. If World War experience can be taken as a guide the population of these extra-camp areas may be expected to increase suddenly from 1/3 to double the pre-existing population. This increase will be made up of: (1) families and friends of the camp inmates, (2) construction workers and their families, (3) civil service employees and their families, (4) job hunters, and (5) what might be termed a major "fifth column" element, a fairly large, miscellaneous group bent on financial gain by legal, illegal, illicit and immoral processes. Gen. Reynolds commenting on this last section says, "Syphilis and gonorrhea will attack the men in training camps unless prostitution, both commercial and clandestine, is controlled". He goes on to cite that last spring there was an outbreak of syphilis and gonorrhea among men in two southern training camps where about 50 percent of 85 prostitutes examined had syphilis or gonorrhea, or both.

This increase in extra-cantonment zone population will mean that housing, hotel, boarding house, eating places of all kinds, water supply and waste disposal facilities will be greatly overtaxed with coincident dangers to cleanliness, sanitation, and health. The control of this situation in such zones will be a function of the local health protection resources. Local health department facilities, even in communities having full time, full scale staffs, are usually overloaded and would not be able to take care of the additional duties without a marked increase in competently trained personnel. This is particularly true of the bacteriological sections, including water supply, waste disposal, and food control, as well as pathogenic and serological work. Commenting on this, Dr. McCormack, Kentucky State Health Commissioner, says, "Only by working their present staff 18 hours a day or more will health departments be able to take care of the extra strain without sacrificing other vital health services". He feels, moreover, that there will be a shortage of competently trained workers even if funds are available to employ them.

In conclusion, the most important duty of the bacteriologist, in war or in the preparation for national defense, is the preservation of health or the prevention of disease. The duties involved are those of the normal program augmented by certain conditions peculiar to the activities concerned. In the combatant forces this work is carried on by their medical

or sanitary corps supplemented by Civil Service employees. In non-military zones, the work is carried on by local health agencies (non-military but governmental), whose employees should be obtained on a basis of merit from federal or local Civil Service lists. It is noted that next week the U.S. Civil Service Commission closes an examination to establish lists of bacteriologists qualified to perform research in special branches of bacteriology, such as anaerobes, viruses, brucellosis, and rickettsiosis.

In the field of sanitation and public health, regardless of whether the crisis facing us lasts 10 years or is over in 6 months, our work will endure and be satisfying; for if it is well done, the results of such work are not only imperative for a successful war, but they are also an essential to happy living in times of peace.

As bacteriologists we have a clear course ahead. Prepare for the apparent duties. Go to work with determination and energy. Let us manifest our patriotism by doing everything possible to aid governmental agencies in the preservation of health.